**Science 10 Physics**

Physics is the study of energy and matter and how they interact.

**Motion** is observed when there is a change in distance between an object and a point in space. Motion is a result of a change in energy of an object.

Motion is measure by the distance an object travels in a specific amount of time.

Calculations can be done with the equation:

v = d / t the base units are meters/second

**Uniform motion** is when an object is traveling in a straight line at a constant speed.

**Scalars and Vectors**

* **Scalar** values only have a magnitude or amount.
* **Vector** values have both a magnitude and a direction. Vector quantities are shown with an arrow above the variable.
* Example: 
  + v is speed (scalar) v is velocity (vector)
  + *scalars* include distance, time, speed, etc.
  + *vectors* include displacement, velocity, etc.

**Distance** is how far an object travels while **displacement** is how far the object is from its original position.

**Speed** is the rate of change in distance when an object is in motion. **Velocity** is calculated like speed except change in displacement is used instead of change of distance of an object.

**Average velocity** can be calculated by using the total displacement and total time of motion.

**Instantaneous velocity** is the speed of an object at any one point in time.

**Graphing**

Motion can also be demonstrated by graphing. Using a **table** of distances and corresponding times we can make a graph showing motion.

All graphs must include a title, labels and units.

Uniform motion produces a straight line of best fit on a distance – time graph.

Graph A Graph B Graph C

Distance Distance Distance

(m) (m) (m)

Time Time Time

(s) (s) (s)

All the above graphs represent uniform motion. Graph A is an object traveling away (positive velocity); Graph B is an object traveling towards or backwards (negative velocity) and Graph C is an object at rest*.*

Slope on a distance-time graph can be found for the line of best fit. The slope is rise divided by run; or distance divided by time. (velocity). Find slope between two chosen points on the line of best fit.

Slope = d2 – d1

t2 – t1

Slope on a distance tome graph is speed.

**Acceleration**

Non uniform motion may be erratic or consistent change in motion. If the motion changes consistently the object speeds up of slows down. This is acceleration or **deceleration**. **Acceleration** is the measure of the rate of change of the velocity of an object. Units are typically meters / seconds2. The formula for calculating acceleration:

a = v / t

On a distance-time graph, acceleration can be recognized by a constant curve:

Acceleration Decceleration

Distance Distance

(m)

Time Time

(s) (s)

Accelerated motion can be tabled and drawn on a velocity-time graph and a straight line of best fit will demonstrate acceleration. The slope on a velocity time graph is the value for acceleration.

Graph E

a =

Velocity

(m/s)

Time

(s)

If the velocity-time graph is a horizontal line there is no acceleration and the object is moving at a constant speed (uniform motion).

The area under a speed-time graph is distance.

**Force**

**Force** is a push or pull exerted on an object.

Newton’s first law of motion states that any object will remain in a constant state of motion unless an unbalanced force is applied to it. When an unbalanced force is applied to an object it will change its motion (or shape).

If equal forces are applied in opposite directions an object will remain in a constant state of motion.

The force due to **gravity** on earth always creates an acceleration of 9.81 m/s2 .

Force is calculated by the formula: **F = m a** (Force equals mass times acceleration.)

The derived units of force are kg m/s2 . These are also called a Newton (N) of force.

**Work**

**Work** is done whenever a force is applied through a distance.

Three conditions must occur for work to be done:

* Movement must occur.
* A force must be applied.
* The movement must be in the same direction as the applied force.

Work is calculated by the formula: **W = F d** (Work equals Force times distance)

The derived units for work are kg m2 / s2 or Nm or a Joule (J).

The work done on an object is equal to its energy change. **W = ∆E**. Both measured in joules.

In a real system some energy is “lost” when work is done. It is most commonly converted to heat as an undesirable energy. When a force is applied to move an object through a distance, it is called input work or energy input. The actual energy gained by the work done is energy output. The difference between the work input and the work output is the energy “lost”.